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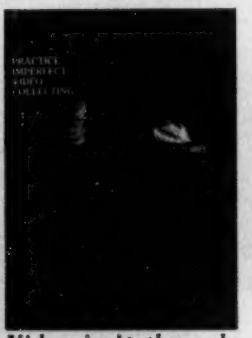

Video isn't the only thing on the mind of Randy Pitman, though he does pose some essential questions in "Pushing Pause: Hesitations About the Video Revolution," page 34. Anne Pitman is Acquisitions Manager for the Kitsap Regional Library, Bremerton, Washington. Photograph © 1989 Rich Frishman

FEATURES

Pushing Pause 34
by Randy Pitman
Hesitations about the video revolution

Books Unbound 38
by Kimberly Olson Fakih
Abridged vs. unabridged audiocassettes

Audiocassette Repair 43
by D. Bolnick & B. Johnson
Doing it yourself and doing it right

Rebab Right 48
by Lelia White
Celebrating an architectural heritage

Toward 100 Percent Availability 50
by Frederick G. Kilgour
The online book and user satisfaction

The International Dimension 54
Censorship and Librarianship in Oman by Stan Gardner

The Forum 58
Nonprint Materials by Peter J. Jacobs

NEWS

Late Bulletins 13
Bay area libraries cope with earthquake damage

News 15
LC postpones MARC licensing agreement

Library Market Outlook 26
by Deborah Selsky

Automation Roundup 28

Ready Reference 31
Methods that work for librarians

Literacy Clearinghouse 33
by Nancy Harvey Davis & Pam Fitzgerald

COLUMNS & DEPARTMENTS

Editorial 4
Liberate Federal Information

How Do You Manage? 60
by A.J. Anderson; Analyses: Roger LaMora & Patricia G. Oyler

White Papers 63
by Herbert S. White

Checklist 65

Letters 6
Calendar 10
People 30
Classified 136
Index to Advertisers 144

November 15, 1989

JOURNAL®

REVIEWS

The Book Review 67

Prepub Alert 68
A personal biography by Germaine Greer

Best Sellers 75
Best-selling audiocassette programs

Reference 76
The latest in Good Reading

Arts & Humanities 83
The Painted Ladies Revisited

Social Sciences 90
Herbert Gold travels in San Francisco

Science & Technology 102
Calvin's neurobiology for the layperson

Fiction 105
Triphammer *probes the male psyche*

Classic Returns 110
A book by Groucho hits the Marx

Professional Reading 112
Offspring of AACR2R

Magazines 114
A down-home magazine from down East

Video Reviews 116
A dual portrait of The Real Weegee

Video Movies 126
A strange film about a dirty old man

Audio Reviews 130
Richard Wright's Black Boy *eloquently read*

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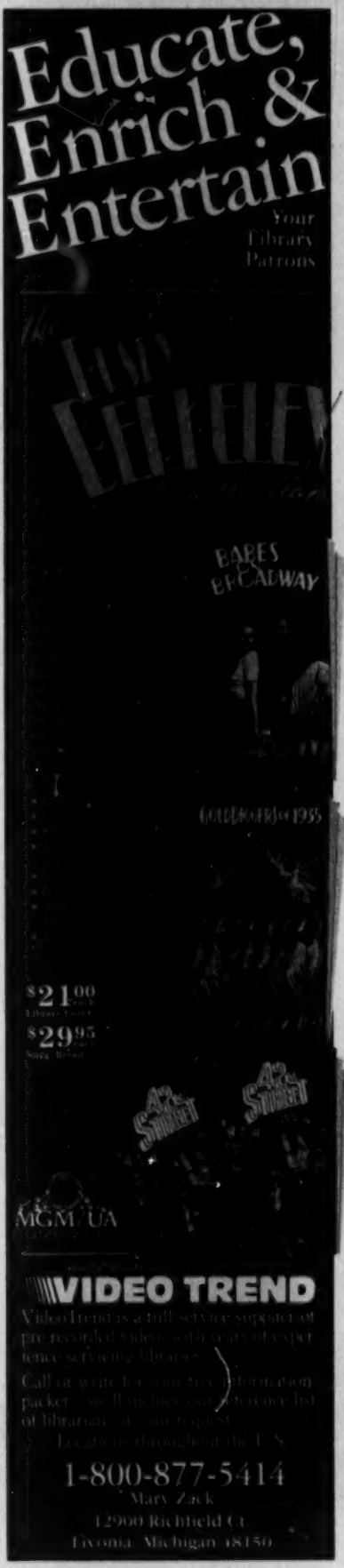


The system will eliminate 60 percent of library user dissatisfaction

Toward 100 Percent Availability

By Frederick G. Kilgour

A SYSTEM for retrieving information from books in machine-readable form will always have the book available for searching from a personal computer or from some other type of access. It is universally known that a comparable statement from a traditional library—that the publications in its catalog are always available on its shelves—would be untrue. This article will document the extent of unavailability of material with traditional library practices and calculate the improvement in availability that a collection of machine-readable books (such as that described in *LJ*, October 1, 1987[1]) will bring about.

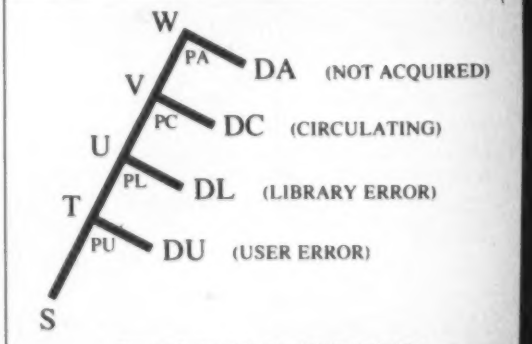
The machine-readable library

Classical library bibliographic systems are designed to put a physical package in the hands of a user, but they often fail to do so. A machine-readable book system provides immediate access to the contents of the package. From a personal microcomputer that may be located in a home, dormitory, office, or school, information seekers will dial the titles in their local library. The library database will contain a collection of records, composed of keys for access, back-of-the-book indexes, tables of contents, and title information.

The inquirer will scan a book's table of contents or index to obtain a page reference for the information sought and then request the page. The local library will transmit the page request to a central site, where the full text of the book will be stored online, and the central site will transmit the page to the library for immediate display on the screen of the requester's remote microcomputer.

Frederick G. Kilgour is Founder Trustee, OCLC Online Computer Library Center, Inc., Dublin, Ohio

Figure 1: Kantor's Branching Diagram



(Source: Kantor, P.B., "Availability Analysis")

Figure 2: Comparison of Performance Measure as Calculated by Kantor (Freiburger study 1975) and by Inversion of Kantor's Sequence

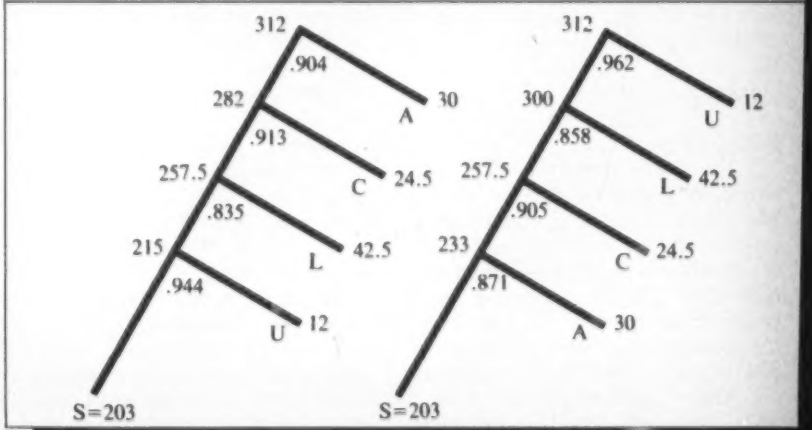


Table 1: Various Calculations of Performance Measures

Performance Measures	Failure Rate	Complement of Failure Rate	Kantor Sequence	Inverted Sequence
P_a	.096	.904	.904	.871
P_c	.079	.921	.913	.905
P_l	.136	.864	.835	.858
P_u	.038	.962	.944	.962
Sum	.349	.651		
Product			.651	.651

Methods & materials

The data used in this study were culled from 16 availability studies carried out over three decades. John Mansbridge's review article[2] was the source of all but three of the references.

Articles selected for this study contained investigations of library book use only and examined only known-item searches. Subject searches were excluded. The searches studied were actual searches made by users; articles employing experimental models were not included. Final evaluation of an article for inclusion was based largely on the materials and methods used in the study. For example, a study was rejected if it only gathered, but did not validate, data from questionnaires handed out to library users. If it only reported percentages and not the data from which the percentages were derived, a study was rejected. Inadequate validation also caused rejection. Poorly designed sampling techniques were another reason for noninclusion.

It was necessary to correct arithmetic errors in other studies, usually in denominators, which produced rates slightly different from the published rates. The corrected rates are used in the tables. There was one study in which the denominator was changed in midstream, so to speak, that defied correction; and another in which the arithmetic yielded an absurdly high failure rate.

Although it was not a criterion that a study should have been carried out in an academic library, there were no studies of public libraries that met the foregoing requirements; consequently, all of the publications report data from academe.

In 1976, Paul B. Kantor published his classic paper, "Availability Analysis,"[3] in which he described his four "branching" categories of error and failure depicted in Figure 1. His "user error" category included error in searching the catalog and error in searching for a book on the shelf. In a study published two years after Kantor's paper, Jo Bell Whitlatch improved the categorization by separating user errors in catalog searches from user errors in searching the shelf.[4] It is Kantor's categorization technique plus Whitlatch's improvement that make possible the analysis and findings in this article.

Some studies produced findings in more categories than were useful in this study, but it was possible to assign them to the categories in the tables. For example, the Whitlatch and Kieffer results[4] were given in seven categories that could be reassembled into five. The analysis presented in this paper relies upon studies in which three categories of failure were segregated: 1) a desired book being in circulation, 2) library errors and procedures, and 3) user errors at the shelf.

Normalizing the data

The best way to improve the availability of books in a library is to reduce the user failure rate in obtaining books. Hence, the basic findings of this investigation will be failure rates determined by reduction of "success," "satisfaction," and "availability" data in the publications cited.

Early authors calculated failure rates by dividing failures into total searches. For example, in Goehlert's work 377 books of 643 requested were not immediately available, giving a failure rate of .586.[5] Recent authors have used Kantor's technique of branching analysis, which yields performance measure values for individual categories that depend on the sequence of the categories. The complements of satisfaction rates are failure rates, but when calculated from Kantor sequence-dependent values they are not the equivalent of dividing failures by the total number of requests. It was necessary to divide each failure number in the Kantor branching diagram or equivalent in each study by the total number of requests, in order to normalize failure rates and make them comparable with the failure rates of the other studies.

Figure 1 represents Kantor's branching analysis, in which W is the number of searches and S the number of successful searches. DA is the number of failed searches due to the library not having acquired the books; DC the number of failures because books were on loan; DL the number resulting from library errors and procedures; and DU from user errors.

$$T = S + DU$$
$$U = T + DL$$
$$V = U + DC$$
$$W = V + DA$$

Performance measures are calculated as follows and in this sequence:

$$Pu = S \div T$$
$$Pl = T \div U$$
$$Pc = U \div V$$
$$Pa = V \div W$$

If this sequence of calculation is inverted, the values of the performance measures are not affected, but when the sequence of the branching is inverted, different performance values result, as shown in Figure 2 and columns 4 and 5 of Table 1. To remove sequence dependency, failure rates are calculated as follows where "F" is substituted for Kantor's "P":

$$Fa = W \div DA$$
$$Fc = W \div DC$$
$$Fl = W \div DL$$
$$Fu = W \div DU$$

Availability performance measures are the complements of these failure rates thus calculated.

Results calculated

The computations of failure rates from the data in six studies comprise Table 2. These studies, carried out from 1951 to 1973, give a combined failure rate of .432. The five investigations in Table 3, done from 1972 to 1983, give a combined rate of .421. The combination of the five in Table 4 is .406, a valid finding in light of the combined failure rates

of .432 and .421 from studies spanning more than three decades.

The most important result of this study is the combined failure rate of .232 obtained by combining and summing columns 7, 8, and 9 in Table 4. Column 7 contains the failure rate resulting from the user error of not finding a book on the shelf, column 8 the failure rates resulting from books being in circulation, and column 9 from library error. Machine-readable systems will eliminate all three types of error, so that availability will rise from .594, the complement of .406, to .826 (1-[.406–.232]), an increase in availability of 38.6 percent.

Table 5 lists the causes of failure to obtain books because of the errors users make when seeking a book at the shelf, because books are in circulation, and as a result of library errors and impediments posed by library procedures. Although libraries have striven for decades to minimize the occurrence of such errors and impediments, it is difficult to see how further reduction could be achieved without incurring exorbitant costs. None of the four causes listed under "In Circulation" and none of the ten under "Library Errors and Procedures" will occur with a machine-readable operation. Nor will the second and third error under "User Errors at the Shelf" happen. However, a user could enter a wrong page number from an index when requesting a page display. Such an error would be analogous to incorrectly copying a call number in a catalog. The user can, however, correct this error more rapidly than a user at a library shelf. Having failed to find the information needed on the page requested, the user can immediately recall the index page to check the page reference.

"Normal" satisfaction

During the last half-century, some libraries have successfully increased their loans of books by decreasing loan periods, by sending overdue notices promptly and repeatedly, and by duplicating heavily used materials. Examples of the first two actions were my work in 1937–38 and 1954.[6] The Saracevic studies in Table 3 are other examples,[7] but the best-known example of increased loans resulting from reduction of loan period and increase in duplication has been the careful and thorough work of Michael Buckland at the University of Lancaster (England) from 1968 to 1970 and later. Buckland achieved an immediate increase of over 100 percent in loans and of 33 percent (from 60 to 80 percent) in "satisfaction level," a measure which does not exactly correspond to the availability rate used in this paper but is close enough for purposes of this discussion.

Two years after his changes, Buckland found that his satisfaction level had declined to the initial 60 percent, although the number of loans was still rising. He explained this phenomenon by likening it to homeostasis, a word describing a physiological concept and defined by its originator as "a condition which may vary but which is relatively constant."[8] Buckland concluded that 60 percent might be "some 'normal' satisfaction level" characteristic of libraries.[9]

His observation and interpretation are important because he made clear for the first time that diminution of user frustration resulting from increased availability is not permanent even though the increase in number of loans continues to rise. Rather, heightened expectations of success cause users to increase requests and bring back into play the same factors listed in Table 5 that caused the original rate of frustration.

It is of the utmost importance to understand that the two-fifths rise in availability rate that a machine-readable book system can achieve will not later decline, because it will eliminate the factors that maintain Buckland's homeostasis.

The improvement in rate of availability of publications that machine-readability will bring about will be 38.6 percent. The rate of user frustration will decline from 40.6 percent to 17.4

Table 2: Failure Rates (1951–1973)

Number of Requests	Failures	Successes	Date of Study	Author
748	344 (.460)	404 (.540)	1951	Gnoza[10]
4614	1928 (.418)	2686 (.582)	1957	Meier[11]
1815	673 (.371)	1142 (.629)	1974–75	Schofield[12]
643	377 (.586)	266 (.414)	1974–75	Goehlert[5]
2375	1097 (.462)	1278 (.538)	1977	Smith[13]
211	81 (.384)	130 (.616)	1973	Kantor[3]
10406	4500 (.432)	5906 (.568)		

Table 3: Inclusive Failure Rate and Four Categories of Failure (1972–1983)

Number of Requests	Inclusive Failures	Successes	Date of Study	Author	Book Not Acquired	User Error	On Loan	Library Errors & Procedures
423	220 (.520)	203 (.480)	1972	Saracevic[7]	52 (.123)	52 (.123)	85 (.201)	31 (.073)
437	192 (.439)	245 (.561)	1974	Saracevic[7]	38 (.087)	54 (.124)	52 (.119)	48 (.110)
312	109 (.349)	203 (.651)	1975	Kantor[3]	30 (.096)	12 (.038)	24.5 (.079)	42.5 (.136)
388	143 (.369)	245 (.631)	1977	Wulff[14]	24 (.062)	35 (.090)	38 (.098)	46 (.119)
760	313 (.412)	447 (.582)	1983	Kolner[15]	48.5 (.064)	44.5 (.059)	115 (.151)	105 (.138)
2320	977 (.421)	1343 (.579)			192.5 (.083)	197.5 (.085)	314.5 (.136)	272.5 (.117)

Table 4: Inclusive Failure Rate and Five Categories of Failure (1976–1984)

No. of Requests	Inclusive Failures	Successes	Date of Study	Author	Book Not Acquired	User Cat. Search Error	(7) User Shelf Error	(8) On Loan	(9) Lib. Err. & Procedures	(7)+(8)+(9)
1365	645 (.473)	720 (.527)	1976	Whitlatch[4]	120 (.088)	210 (.154)	96 (.070)	143 (.105)	76 (.056)	315 (.231)
1050	388 (.370)	662 (.630)	1980	Palais[16]	54 (.051)	63 (.060)	89 (.085)	68 (.065)	114 (.109)	271 (.258)
509	143 (.281)	366 (.719)	1980	Rinkel[17]	10 (.020)	48 (.094)	31 (.061)	29 (.057)	25 (.049)	85 (.167)
421	188 (.447)	233 (.553)	1981	Mansbridge[18]	35 (.083)	51 (.121)	4 (.010)	68 (.162)	30 (.071)	102 (.242)
408	158 (.387)	250 (.613)	1984	Ferl[19]	40 (.098)	21 (.051)	9 (.022)	63 (.154)	25 (.061)	97 (.238)
3753	1522 (.406)	2231 (.594)			259 (.069)	393 (.108)	229 (.061)	371 (.099)	270 (.072)	870 (.232)

Table 5: Causes of Failure To Obtain Books

User Errors at the Shelf
- Copied call number incorrectly
- Book in another collection but not noted
- On shelf in correct place but not found

In Circulation
- On loan
- In use in building
- Being held for a borrower
- On reserve

Library Errors and Procedures
- Wrong call number on location in catalog
- Catalog card misfiled
- Loan record awaiting filing
- Loan record misfiled
- Awaiting shelving
- Awaiting photocopying
- Misshelved
- In process of transfer to another location
- Missing and known to be missing by library
- Not accounted for

percent and may drop further, for, unlike past library improvements, such a system will eliminate the factors causing at least three-fifths of user dissatisfaction.

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